

Critical Thinking About Science News

Using critical thinking to evaluate current events in science

How can we use critical thinking to avoid being manipulated by logical fallacies in science?

What are Logical Fallacies?



Your face is mighty mite-y.
And that's a good thing



Read and Annotate this article
from [Science News Explores](#)

**Include the following in your
annotations:**

Underline key ideas.

Important information

Unfamiliar word

?Wonders/Confusing details?

**Based on the article, make a claim. Feel free to use
questionable logic. Write it in your science notes.**

Padlet Wall Posts



1. Post your claim on our Padlet Wall.
2. Read through the other posts.
3. Pick the top three most dubious claims.
4. The more dubious the claim, the higher the numerical ranking you should give.
5. Add a comment/question addressing the **validity** of the claim.

**What were our top three
dubious claims?**

Why?

Do any of these logical fallacies apply to our dubious claims?

Which one(s) and why?

strawman

Misrepresenting someone's argument to make it easier to attack.

By exaggerating, misrepresenting, or just completely fabricating someone's argument, it's much easier to present your own position as being reasonable, but this kind of dishonesty serves to undermine rational debate.

After Will said that we should be nice to kittens because they're fluffy and cute, Bill says that Will is a cat supremacist who wants to be mean to poor defenseless puppies.

false cause

Presuming that a real or perceived relationship between things means that one is the cause of the other.

Many people confuse correlation (things happening together or in sequence) for causation (that one thing actually causes the other to happen). Sometimes correlation is coincidental, or it may be attributable to a common cause.

Pointing to a fancy chart, Roger shows how temperatures have been rising over the past few centuries, while at the same time the numbers of pirates have been decreasing; thus pirates cool the world and global warming is a hoax.

appeal to emotion

Manipulating an emotional response in place of a valid or compelling argument.

Appeals to emotion include appeals to fear, envy, hatred, pity, guilt, and more. Though a valid, and reasoned, argument may sometimes have an emotional aspect, one must be careful that emotion doesn't obscure or replace reason.

Luke didn't want to eat his sheep brains with chopped liver and Brussels sprouts, but his father told him to think about the poor, starving children in a third world country who weren't fortunate enough to have any food at all.

the fallacy fallacy

Presuming a claim to be necessarily wrong because a fallacy has been committed.

It is entirely possible to make a claim that is false yet argue with logical coherence for that claim, just as it is possible to make a claim that is true and justify it with various fallacies and poor arguments.

Recognizing that Amanda had committed a fallacy in arguing that we should eat healthy food because a nutritionist said it was popular, Alyse said we should therefore eat bacon double cheeseburgers every day.

slippery slope

Asserting that if we allow A to happen, then Z will consequently happen too, therefore A should not happen.

The problem with this reasoning is that it avoids engaging with the issue at hand, and instead shifts attention to baseless extreme hypotheticals. The merits of the original argument are then tainted by unsubstantiated conjecture.

Colin asserts that if we allow children to play video games, then the next thing you know we'll be living in a post-apocalyptic zombie wasteland with no money for guard rails to protect people from slippery slopes.

ad hominem

Attacking your opponent's character or personal traits in an attempt to undermine their argument.

Ad hominem attacks can take the form of overtly attacking somebody, or casting doubt on their character. The result of an ad hominem attack can be to undermine someone without actually engaging with the substance of their argument.

After Sally presents an eloquent and compelling case for a more equitable taxation system, Sam asks the audience whether we should believe anything from a woman who isn't married and probably eats her own boogers.

tu quoque

Avoiding having to engage with criticism by turning it back on the accuser - answering criticism with criticism.

Literally translating as 'you too' this fallacy is commonly employed as an effective red herring because it takes the heat off the accused having to defend themselves and shifts the focus back onto the accuser themselves.

Nicole identified that Hannah had committed a logical fallacy, but instead of addressing the substance of her claim, Hannah accused Nicole of committing a fallacy earlier on in the conversation.

personal incredulity

Saying that because one finds something difficult to understand, it's therefore not true.

Subjects such as biological evolution via the process of natural selection require a good amount of understanding before one is able to properly grasp them; this fallacy is usually used in place of that understanding.

Kirk drew a picture of a fish and a human and with effusive disdain asked Richard if he really thought we were stupid enough to believe that a fish somehow turned into a human through just, like, random things happening over time.

special pleading

Moving the goalposts or making up exceptions when a claim is shown to be false.

Humans are funny creatures and have a foolish aversion to being wrong. Rather than appreciate the benefits of being able to change one's mind through better understanding, many will invent ways to cling to old beliefs.

Edward Johns claimed to be psychic, but when his 'abilities' were tested under proper scientific conditions, they magically disappeared. Edward explained this saying that one had to have faith in his abilities for them to work.

loaded question

Asking a question that has an assumption built into it so that it can't be answered without appearing guilty.

Loaded question fallacies are particularly effective at derailing rational debates because of their inflammatory nature - recipients of a loaded question are compelled to defend themselves and may appear flustered or on the back foot.

Grace and Helen were both romantically interested in Brad. One day, with Brad sitting within earshot, Grace asked in an inquisitive tone whether Helen was having any problems with a fungal infection.

burden of proof

Saying that the burden of proof lies not with the person making the claim, but with someone else to disprove.

The burden of proof lies with someone who is making a claim, and is not upon anyone else to disprove. The inability, or disinclination, to disprove a claim does not make it valid (however we must always go by the best available evidence).

Bertrand declares that a teapot is, at this very moment, in orbit around the Sun between the Earth and Mars, and that because no one can prove him wrong his claim is therefore a valid one.

ambiguity

Using double meanings or ambiguities of language to mislead or misrepresent the truth.

Politicians are often guilty of using ambiguity to mislead and will later point to how they were technically not outright lying if they come under scrutiny. It's a particularly tricky and premeditated fallacy to commit.

When the judge asked the defendant why he hadn't paid his parking fines, he said that he shouldn't have to pay them because the sign said 'Fine for parking here' and so he naturally presumed that it would be fine to park there.

the gambler's fallacy

Believing that 'runs' occur to statistically independent phenomena such as roulette wheel spins.

This commonly believed fallacy can be said to have helped create a city in the desert of Nevada USA. Though the overall odds of a 'big run' happening may be low, each spin of the wheel is itself entirely independent from the last.

Red had come up six times in a row on the roulette wheel, so Greg knew that it was close to certain that black would be next up. Suffering an economic form of natural selection with this thinking, he soon lost all of his savings.

bandwagon

Appealing to popularity or the fact that many people do something as an attempted form of validation.

The flaw in this argument is that the popularity of an idea has absolutely no bearing on its validity. If it did, then the Earth would have made itself flat for most of history to accommodate this popular belief.

Shamus pointed a finger at Sean and asked him to explain how so many people could believe in leprechauns if they're only a silly old superstition. Sean wondered how so many people could believe in things based on popularity.

appeal to authority

Saying that because an authority thinks something, it must therefore be true.

It's important to note that this fallacy should not be used to dismiss the claims of experts, or scientific consensus. Appeals to authority are not valid arguments, but nor is it reasonable to disregard the claims of experts who have a demonstrated depth of knowledge unless one has a similar level of understanding.

Unable to defend his argument that the Earth is flat, Bob said that his friend Terry was a qualified botanist who also believed the Earth to be flat, and had even seen it from up in a tree.

composition/division

Assuming that what's true about one part of something has to be applied to all, or other, parts of it.

Often when something is true for the part it does also apply to the whole, but because this isn't always the case it can't be presumed to be true. We must show evidence for why a consistency will exist.

Daniel was a precocious child and had a liking for logic. He reasoned that atoms are invisible, and that he was made of atoms and therefore invisible too. Unfortunately, despite his theory skills, he lost the game of hide and go seek.

no true scotsman

Making what could be called an appeal to purity as a way to dismiss relevant criticisms or flaws of an argument.

This fallacy is often employed as a measure of last resort when a point has been lost. Seeing that a criticism is valid, yet not wanting to admit it, new criteria are invoked to dissociate oneself or one's argument.

Angus declares that Scotsmen do not put sugar on their porridge, to which Lachlan points out that he is a Scotsman and puts sugar on his porridge. Furious, like a true Scot, Angus yells that no true Scotsman sugars his porridge.

genetic

Judging something good or bad on the basis of where it comes from, or from whom it comes.

To appeal to prejudices surrounding something's origin is another red herring fallacy. This fallacy has the same function as an ad hominem, but applies instead to perceptions surrounding something's source or context.

Accused on the 6 o'clock news of corruption and taking bribes, the senator said that we should all be very wary of the things we hear in the media, because we all know how very unreliable the media can be.

black-or-white

Where two alternative states are presented as the only possibilities, when in fact more possibilities exist.

Also known as the false dilemma, this insidious tactic has the appearance of forming a logical argument, but under closer scrutiny it becomes evident that there are more possibilities than the either/or choice that is presented.

Whilst rallying support for his plan to fundamentally undermine citizens' rights, the Supreme Leader told the people they were either on his side, or on the side of the enemy.

begging the question

A circular argument in which the conclusion is included in the premise.

This logically incoherent argument often arises in situations where people have an assumption that is very ingrained, and therefore taken in their minds as a given. Circular reasoning is bad mostly because it's not very good.

The word of Zorbo the Great is flawless and perfect. We know this because it says so in The Great and Infallible Book of Zorbo's Best and Most Trust Things that are Definitely True and Should Not Ever Be Questioned.

appeal to nature

Making the argument that because something is 'natural' it is therefore valid, justified, inevitable, good, or ideal.

Many 'natural' things are also considered good, and this can bias our thinking; but 'naturalness' itself doesn't make something good or bad. For instance, murder could be seen as very 'natural', but that doesn't mean it's justifiable.

The medicine man rolled into town on his bandwagon offering various natural remedies, such as very special plain water. He said that it was only natural that people should be wary of 'artificial' medicines like antibiotics.

anecdotal

Using personal experience or an isolated example instead of a valid argument, especially to dismiss statistics.

It's often much easier for people to believe someone's testimony as opposed to understanding variation across a continuum. Scientific and statistical measures are almost always more accurate than individual perceptions and experiences.

Jason said that was all cool and everything, but his grandfather smoked, like, 30 cigarettes a day and lived until 97 - so don't believe everything you read about meta analyses of well-designed studies showing proven causal relationships.

the texas sharpshooter

Cherry-picking data clusters to suit an argument, or finding a pattern to fit a presumption.

This 'false cause' fallacy is coined after a marksman shooting at barns and then painting a bullseye target around the spot where the most bullet holes appear. Clusters naturally appear by chance, and don't necessarily indicate causation.

The makers of Sugarette Candy Drinks point to research showing that in the six countries where Sugarette drinks sell the most units, three of them are in the top ten healthiest countries on Earth, therefore Sugarette drinks are healthy.

middle ground

Saying that a compromise, or middle point, between two extremes must be the truth.

Much of the time the truth does indeed lie between two extreme points, but this can bias our thinking; sometimes a thing is simply untrue and a compromise of it is also untrue. Half way between truth and a lie, is still a lie.

Holly said that vaccinations caused autism in children, but her scientifically well-read friend Caleb said that this claim had been debunked and proven false. Their friend Alice offered a compromise that vaccinations cause some autism.

thou shalt not commit logical fallacies

A logical fallacy is a flaw in reasoning. Strong arguments are void of logical fallacies, whilst arguments that are weak tend to use fallacies in place of cogent logic. They're like tricks or illusions of thought, and they're often very sneakily used by politicians, the media, and they're to fool people. Don't be fooled!

This poster has been designed to help you identify and call out dodgy logic wherever it may raise its ugly, incoherent head. If you see someone committing a logical fallacy online, link them to the relevant one e.g. yourfallacy.is/strawman

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Download this poster at www.yourfallacy.is

Claims, Evidence and Reasoning

We use claims, evidence and reasoning to make sense of science.

If we don't have solid evidence and reasoning that logically links our claims and evidence, our claims risk becoming invalidated.

Science that isn't valid is BAD science!

CERs in Science

Hypotheses are usually claims.

The data that you collect is evidence to *support or disprove* your claim.

Reasoning links your claims to your evidence. This is where critical thinking comes in!

Reconsidering our Padlet Claims

**Which of our claims has
the most solid reasoning?**

Why?

How can we use critical thinking to avoid being manipulated by logical fallacies in science?

Strategies to Support Critical Thinking

- Collect additional data
- Assume that we are wrong until we have collected enough data to provide strong support for our claim.
- Consider all possible options- even those opposite of the current claim/evidence.
- Ask for outside perspectives.
- Question authority!
- Slow down the decision making process. Ask for additional time to think or discuss.

Strategies to Support Critical Thinking

- Make decisions in an environment where you don't feel pressured by other people.
- Is it possible that there could be more than one correct choice?
- Take a break! If you have reached your frustration point or are struggling to think clearly, step away from the problem for a bit and come back to it later.
- Check the data using another strategy.

**Critical Thinking is your
superpower in the fight against
logical fallacies in science!**

Which strategies will you use?

